



Growing Up A Tree

FROM SEED TO SEEDLING

Starting Out a Seed: Most trees begin as seeds. A seed is really a tiny blueprint of the tree to come. The tiny embryo inside is complete with parts that will eventually develop into a stem, roots, and leaves. Also included is a storehouse of energy—a supply of food in the form of starch, and sugar. This food nourishes the living embryo while the seed lies dormant. After the seed germinates, or sprouts, the food supplies the embryo with energy for growth until leaves are formed and photosynthesis can begin.

Move It or Lose It: When it comes to reproduction, trees—like all plants—are big-time gamblers. Each season's production of seeds is a game of chance in which the odds of any seed becoming a mature tree are about one in a million.

A seed that ends up at the base of the parent tree may sprout there and become a seedling. With luck the seedling will become a *sapling*, or young tree. But unless the parent tree dies, is knocked down in a storm, or is cut down, the sapling has little chance of becoming a mature tree. There's usually no way it can successfully compete with the parent for enough light.

Their chances of surviving are improved if seeds can be spread to other areas, or *dispersed*. So the seeds of most trees are made to travel.

"Oh, Give Me a Home. . .": Travel, of course, has its own hazards. Seeds have many amazing ways of getting around, but they cannot control exactly *where* they go. A floating coconut, which needs to land on a sandy shore to sprout, may drift for years at sea. A maple seed sailing on the wind can end up in someone's backyard and, although it succeeds in sprouting, may fall prey to a lawn mower. A cedar seed that needs lots of sunlight may land in the shade of a deep forest. And a cottonwood tuft that needs a moist stream bank may end up on a dry, dusty roadside. To sprout and begin growing, a seed must—by luck—fall in a place with the right amount of light, right temperature range, right amount of moisture, and sufficient and suitable soil.

Ready, Set, Grow!: If a healthy seed lands in just the right spot, it begins to grow. (Some species need to lie dormant through freezing temperatures before they can sprout; others can sprout right away.) First the seed begins to absorb water from the soil, causing the embryo inside to grow larger. Next a tiny root tip pokes its way through the seed's hard outer covering (called the *seed coat*) and digs into the soil. Soon, tiny root hairs begin to sprout along the root. These tiny strands push between particles of soil, absorbing water and minerals. The mineral-rich root sap flows up to the rest of the tiny seedling. With a steady supply of water and minerals, the seedling next sends out a stem. Cells inside the stem begin to grow and multiply, sending the future tree trunk up through the soil. (Special chemicals in the stem, called growth hormones, cause the stem to grow *up*, against gravity.) Soon, usually within a few days, the new stem breaks through the surface of the soil.

FROM SEEDLING TO ADULT

Laying On the Layers: Once a seedling breaks ground, it's on its way to becoming a young tree. Leaves grow and immediately begin the job of making food. During its first growing season, the young tree's phloem and xylem cells transport food, water, and minerals to all parts of the tiny seedling. As more woody xylem cells form, the stem becomes thicker and stronger.

It's Up to You, Bud: As a tree grows, it not only develops a thicker trunk—it also grows taller. Trees grow taller only at the tip of the trunk and at the tips of the branches. They do this by forming *terminal buds*. Each bud contains a tiny shoot that, on most trees, is wrapped in protective *bud scales*. The scales form a tough, weatherproof "suit of armor." When the bud sprouts, a new green stem starts to grow and eventually becomes a new branch. Besides having buds on the tips of their branches, most trees also have buds that form on the *sides* of their branches (called *lateral buds*).

Shutting Down for Winter: Tree growth slows as cold weather approaches, and the buds that formed during the growing season eventually become dormant. In deciduous trees, chlorophyll in the leaves gradually breaks down and photosynthesis eventually stops. Because water is not as available to trees during cold weather as it is during the growing season (it freezes and is not as easily absorbed by the roots), shutting down photosynthesis is one way deciduous trees can survive the winter. (plants need water in order for photosynthesis to take place.) And since deciduous trees don't photosynthesize during winter, they no longer need their leaves. So deciduous trees simply get rid of their leaves as the weather turns colder. Many evergreens survive winter or the dry season with their leaves still hanging on because they have special adaptations to compensate for scarce water supplies. For example, many evergreen leaves are covered with a thick, waxy coating that helps hold water in and prevents evaporation. Also, the leaves of some evergreens contain a kind of natural antifreeze that helps prevent injury to water-filled cells.

Making More Trees: Most trees reproduce sexually. That means male cells (formed in the pollen) unite with eggs (formed in the cones or blossoms, depending on the type of tree) to make seeds. But many trees can also reproduce *vegetatively*, which means they can grow from a part of the living tree. Some trees grow from *suckers*, which are shoots that sprout from the roots. Other trees can grow when twigs fall to the ground and eventually form roots. Many trees can also sprout from stumps.

GROWING UP A FOREST

Trees grow together in communities called *forests*. The types of trees that grow in a particular forest community depend on the climate in the area and the type of soil that is found there. Although there are thousands of species of trees in the world, scientists have divided the world's forests into four major groups:

Boreal Forests: These form a broad band across northern Canada, Europe, and Asia. Boreal forests are made up mostly of firs, spruces, and other needle-leaved trees that are adapted to cold winters and a short growing season.

Mixed Forests: South of the boreal forests are areas of mixed forests, made up of conifers and deciduous trees. Mixed forests grow across much of North America, Europe, and Asia, in areas where the climate is milder than it is in the boreal areas.

Deciduous Forests: In many temperate areas broad-leaved deciduous trees such as beech, maple, oak, and hickory form large tracts of deciduous forests. (Deciduous forests often contain some pines, hollies, and other evergreens, but these usually aren't the dominant trees.) In the past, much of North America and parts of Europe were covered with unbroken tracts of deciduous forests.

Tropical Forests: These forests, which grow in parts of Central and South America, Africa, Asia, and Australia, form a broad band around the equator. Because they grow in areas where there are warm temperatures year round, long hours of daylight, and lots of rain, these forests are lush and productive. Most of the trees that grow in these forests are broad-leaved evergreens.

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